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Palyno-Morphological Studies of Some Species of Acanthaceae Family

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Abstract

Present paper deals with palyno-morphological studies of some species of the Acanthaceae family.Pollens were excised from fresh newly opened flowers were collected from Government Vidarbha Institute of Science and Humanities (GVISH) Amravati campus. It is determined that Morpho-palynological markers can be used as important supportive tools to mark out the Acanthaceae family at various taxonomic levels. This study concentrated on shape, number of colpi, size and surface characters of pollen grains of selected plant species. The percentage of pollen viability was 100% by acetocarmine test. In vitro germination was assessed with the hanging drop method and sitting drop method. This study is helpful in the differentiation and identification of plant species among other families and within family.

Keywords: Palyno-morphology, Acanthaceae, Pollen, Viability, In-vitro germination.

Introduction

Nowadays, palynology, as an organismic-based science, can serve as an indispensable tool for various applied sciences, but clearly also can stand alone as one of the most developed basic sciences. In general, compared to the diplont the male gametophyte in seed plant is yet poorly investigated. From at least 250000 plant species only ca 10 percent have been studied with respect to pollen grain morphology, and regarding pollen grain anatomy it is much less. The use of palynological studies in solving taxonomic problems is gradually gaining grounds with vigorous extensive investigation in the field of science.

Pollen grains are reduced, non-motile, microscopic male gametophytes which, upon pollination, produce pollen tubes that grow through the pistil for effective fertilization and seed set. Pollen fertility and viability have a paramount importance in plant reproduction. So pollen fertility, viability, and its longevity are basic aspect for the improvement of plant before going to successful breeding programme. Viability has been defined as having the capacity to live, grow, germinate or develop (Lincoln et al. 1982). Diversified morphological details of pollen characters like pollen shape, symmetry, size, polar equatorial outlines, number of aperture wall or exine thickness, pore diameter and exine or wall ornamentation are significant attributes of potential taxonomic importance that are diagnostic at the species level and provides a useful data for the intergeneric classification of the larger genera. The differences and similarities in pollen morphology of some investigated species showed significant evidences and could be exploited for biosystematic purposes. The variations in shape, aperture, pollen unit, symmetry and differences in wall sculpture of pollen grains have been used by many authors in the delimitation of various taxa.

Acanthaceae is a large pantropical family consisting of nearly 250 genera and 2500 species (Mabberley, 1987). About 70 genera and 340 species have been reported from India. The study was aimed at improving the general knowledge of the palynology in this family which has received very little attention in this, field of research. The taxonomic value of pollen grain character in Acanthaceae was first pointed out by Radlkofer(1883). The current work entitled has been carried out with the intention to provide an account of pollen morpholological features of some Acanthaceae members as a basis for future studies.

Material and Methods

Plants were collected and identified with the help of standard floras (Naik 1998 and Dhore 1986).To avoid The storage and preservation of pollens, pollens were excised from fresh newly opened flowers at every time. The pollen morphology comparative analysis and several parameters measurements were

performed with light microscopy. Pollen viability was performed by the acetocarmine test. In vitro pollen germination were performed with the hanging drop method and sitting drop method (Shivanna and Rangaswamy, 1992).

Observations

Pollen Morphology

This study concentrated on shape, number of colpi, size and surface characters of pollen grains of selected plant species. The main features of the pollen are summarized in Table 1. However, when observed under the light microscope, the stained slide is clearer because of better contrast. The grains will appear as various shaped tiny particles with ornamentations. The unstained slide appears more transparent /translucent and does not give a clear view of the grain surface. Conversely, the appearance of the grains is also largely dependent on the type of plant from which the pollen was obtained. The immature pollen grains are variable in their shape, size and ornamentation.

Table 1: Palyno-morphological characters of selected plant species.

Morphological character		**Name of plants**					
		Asystasia	***Barleria***	***Eranthemum***	***Justicia***	***Rungia***	***Thunbergia***
Viability		100%	100%	100%	100%	100%	100%
Shape		Prolate	Oblate-spheroidal	Spheroidal	Prolate	Prolate	Oblate-spheroidal
Type of aperture		Tricolporate	Tricolporate	Polyads	Tricolporate	Tricolporate	Spiraperturate
Size	**Length (µm)**	57.6			42	30	
	Width (µm)	42.4			31	19	
	L/W	1.35			1.35	1.57	
	Diameter (µm)		61-73	72.9			53.7
Polar outline		Triangular-obtuse plane	circular	Circular	Triangular-obtuse plane	Triangular-obtuse plane	Circular
Surface pattern		Reticulate	Reticulate	Reticulate	Reticulate	Reticulate	Baculate or microechinulate

Pollen Viability

Pollen viability determined by acetocarmine test. No significant differences among the selected plant species were found in pollen viability for the acetocarmine tests carried out. The percentage of pollen viability was 100% by acetocarmine test summarized in table 2.

Table 2: Pollen viability (%) of selected plants determined by acetocarmine.

Plant Species	**No. of Stained Pollen grains**	**No. of Unstained Pollen grains**	**Total no. of Pollen Grains**	**Pollen Viability %**
Asystasia dalzeliana (Bl.)	348	0	348	100
Barleria prionitis (L.)	103	0	103	100
Eranthemum pulchellum (L.)	157	0	157	100
Justicia gendarussa (Burm.)	386	0	386	100
Rungia repens (L.)	597	0	597	100
Thunbergia laevis Wall. ex Nees	213	0	213	100

However, there is no universal viability test which is quick, simple, and reliable. Staining with nonvital stains may be useful to determine the degree of pollen sterility in plants of hybrid origin or those grown under unfavorable conditions, but it is not useful for assessing pollen viability (Heslop-Harrison et al. 1984). From time to time many pollen viability tests have been standardized. It is necessary to apply different tests for a given pollen system and find out the one that reflects true viability.

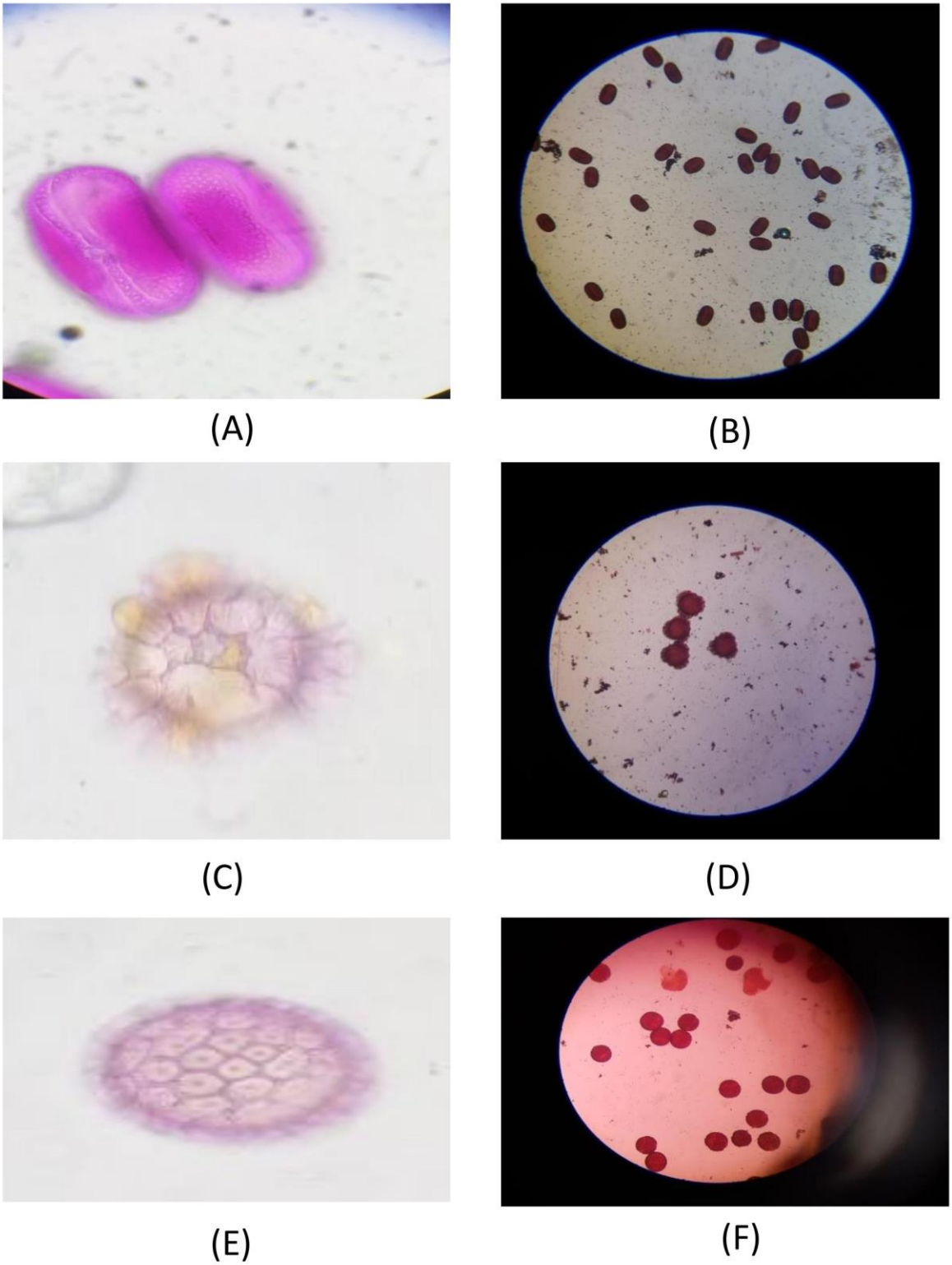

Figure 1: LM micrographs showing surface ornamentation (Fuchsin stained) of pollen grains and stained pollen grains (Acetocarmine) of studied species (A -B) *Asystasia dalzeliana*(BL.); (C-D) *Barleria prionitise* (L.); (E-D*) Eranthemum pulchellum*(L.)

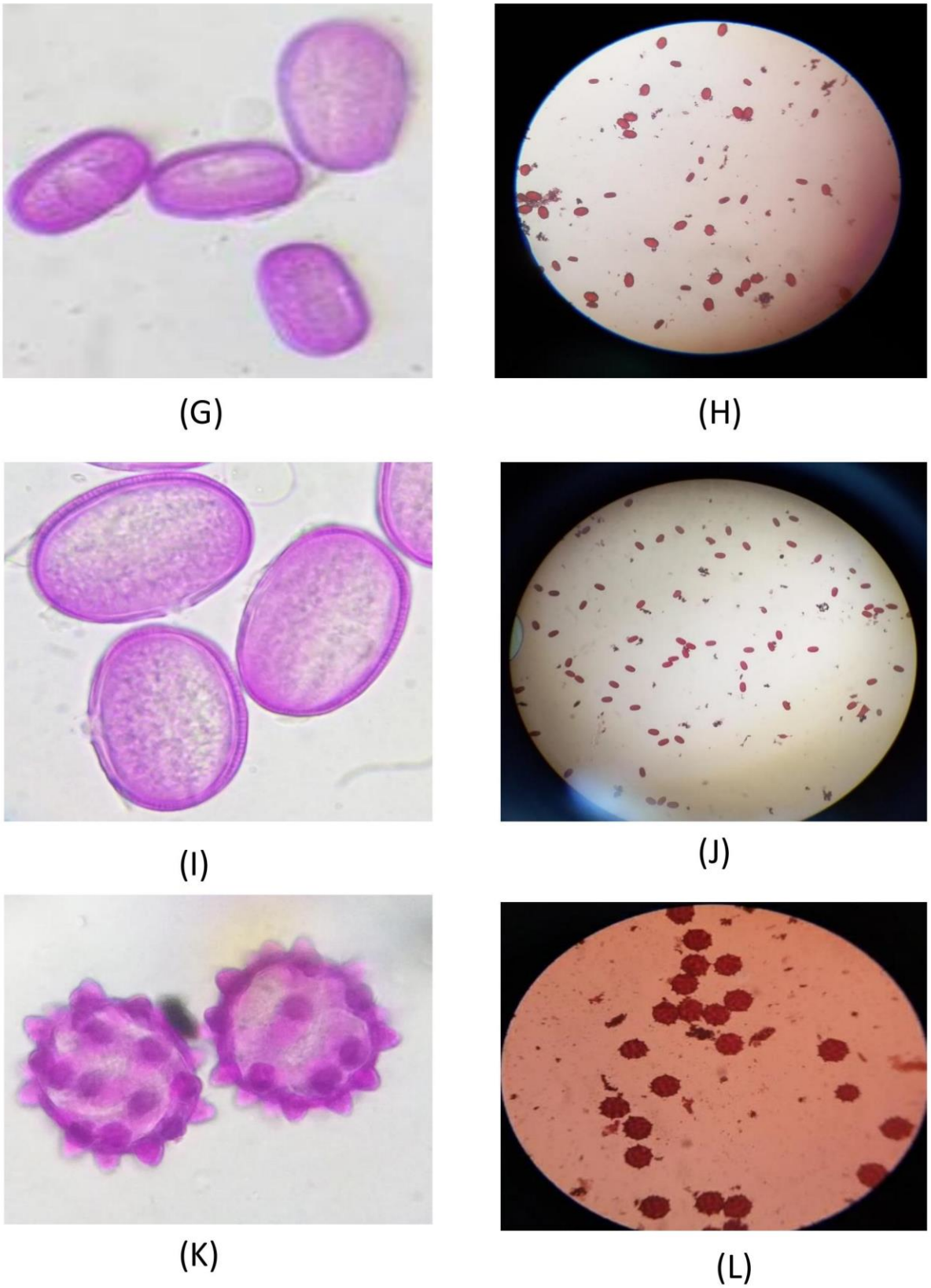

Figure 2: LM micrographs showing surface ornamentation (Fuchsin stained) of pollen grains and stained pollen grains (Acetocarmine) of studied species G-H *Justicia gendarussa*(Burm.); I-J *Rungia repens*(L.); K-L *Thunbergia laevis* (Wall. ex Nees)

In vitro pollen germination

The results showed that pollen germination rates and pollen tube growth were not observed in selected plant species under the selected medium and environmental conditions. A major limitation of this test is the difficulty in achieving satisfactory germination in many species, especially in three-celled pollen systems. Also, the medium which elicits optimal germination of fresh pollen may not be suitable for stored pollen (Johri and Vasil 1961).

Result and Conclusion

It is determined that Morpho-palynological markers can be used as important supportive tools to mark out the Acanthaceae family at various taxonomic levels. In terms of taxonomic usefulness exine thickness, pollen shape, equatorial and polar diameters, pore diameter regarding palynology are important features. The present study is considered to be useful in the field of herbal medicine and drugs. In short, this study is helpful in the differentiation and identification of plant species among other families and within family.

In determining the pollen quality of selected plant species of Acanthaceae, viability tests are often considered to be faster and easier methods than the germination tests, since the effects of external factors such as temperature, humidity, and germinating media are minimized. Results of the present study strongly supported this approach. Acetocarmine could be used in determining the pollen viability and to indicate germination status in selected plant species. The selected plant species appear to have sufficient pollen viability. All of them could be used in pollination and breeding programs; however, this needs to be tested by in vivo pollinations study.

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References

1. **Dafni,** "Pollination ecology: a practical approach", (1992), Oxford University Press.
2. **Moutinho, L. Camacho, A. Haley, M. S. Pais, A. Trewavas,, & R. Malhó,** "Antisense perturbation of protein function in living pollen tubes. Sexual Plant Reproduction", (2001), 14(1-2), 101-104
3. **Gaaliche, A. Majdoub, M. Trad, & M. Mars,** "Assessment of pollen viability, germination, and tube growth in eight tunisian caprifig (Ficus carica L.) cultivars", (2013). ISRN Agronomy, 2013.
4. **M. Johri and, I.K. Vasil**, "Physiology of Pollen. Botanical Review", (1961), 27(3):318-381.
5. **H. Morse,** "Roles of pollen and ovary age in follicle production of the common milkweed Asclepias syriaca", American Journal of Botany, (1987), 74(6), 851-856.
6. **J. Mabberley, "**The plant-book: a portable dictionary of the vascular plants. Cambridge university press", (1997).
7. **D. Lindgren, L. Paule, S. Xihuan, R. Yazdani, U. Segerström, J. E. Wallin, & M. L. Lejdebro,** "Can viable pollen carry Scots pine genes over long distances? Grana", (1995), 34(1), 6469.
8. **D. Mulugeta, B. D. Maxwell, P. K. Fay, & W. E. Dyer,** "Kochia (Kochia scoparia) pollen dispersion, viability and germination", Weed science, (1994), 42(4), 548-552.
9. **D. V. Beardsell, R. B. Knox, &, E. G. Williams**. "Breeding system and reproductive success of Thryptomene calycina (Myrtaceae)", (1993), Australian Journal of Botany, 41(3), 333-353.
10. **Ottaviano,, D. L. Mulcahy,, M. S. Gorla,, & G. B. Mulcahy,** (Eds.). "Angiosperm pollen and ovules", Springer Science & Business Media, (2012).
11. **Erdtman,** "Handbook of palynolgy: Morphology, taxonomy, ecology. An introduction to the study of pollen grains and spores", (1969), Hafner.

12. **Erdtman,** "Pollen morphology and plant taxonomy". Geologiska Föreningen i Stockholm Förhandlingar, (1952), 74(4), 526-527.
13. **G. Lindau,** "Acanthaceae. In: A. Engler and (K.) Prantl [eds.], Die natrlichen Pflanzenfamilien" (1895).
14. **G. Vaughton, & M. Ramsey,** "Floral biology and inefficient pollen removal in Banksia spinulosa var neoanglica (Proteaceae)", Australian Journal of Botany, (1991), 39(2), 167-177.
15. **G. Baker, & I. Baker,** "Starch in angiosperm pollen grains and its evolutionary significance." American Journal of Botany, (1979), 66(5), 591-600.
16. **Heslop-Harrison, & Y. Heslop-Harrison,** "Germination of monocolpate angiosperm pollen: effects of inhibitory factors and the Ca2+-channel blocker, nifedipine", (1992), Annals of Botany, 69(5), 395-403.
17. **Heslop-Harrison, "**The Evaluation of Pollen Quality And A Further Appraisal Of The Fluorochromatic (Fcr) Test Procedure", (1984), Vol-67.
18. **R. Shivanna, & J. Heslop-Harrison, "**Membrane state and pollen viability", Annals of Botany, (1981), 47(6), 759-770.
19. **K. R. Shivanna, & N. S. Rangaswamy,** "Pollen biology: a laboratory manual', Springer Science & Business Media, (2012).
20. **G. Ma, Q. S. Fan, Z. Q. Yu, H. L. Zhou, F. S. Zhang, & D. Y. Sun,** "Does aluminum inhibit pollen germination via extracellular calmodulin? Plant and Cell Physiology", (2000), 41(3), 372-376.
21. **L. P. Taylor, & P. K. Hepler,** "Pollen germination and tube growth. Annual review of plant biology", (1997), 48(1), 461-491.
22. **L. Radlkofer,** 'On the systematic value of pollen quality in acanthaceae", Academic book printing by F. Straub, (1883).
23. **R. A. Niesenbaum,** "Sex ratio, components of reproduction, and pollen deposition in Lindera benzoin (Lauraceae)", American Journal of Botany, (1992), 79(5), 495-500.
24. **R. E. Preston,** "The intrafloral phenology of Streptanthus tortuosus (Brassicaceae)", American Journal of Botany, (1991), 78(8), 1044-1053.
25. **R. G. Stanley, & H. F. Linskens,** "Biology Biochemistry Management. Berlin: Heidelberg", (1974).
26. **R. J. Lincoln,** "A dictionary of ecology, evolution and systematics", (1998), (No. C/574.5 L5).
27. **Y. Shchori, T. Goren, & J. Ben-Jaacov, "**Pollen germination and storage in Banksia and some other proteaceae plants", In International Workshop on Intensive Cultivation of Protea 316, (September 1990),(pp. 18-21).